

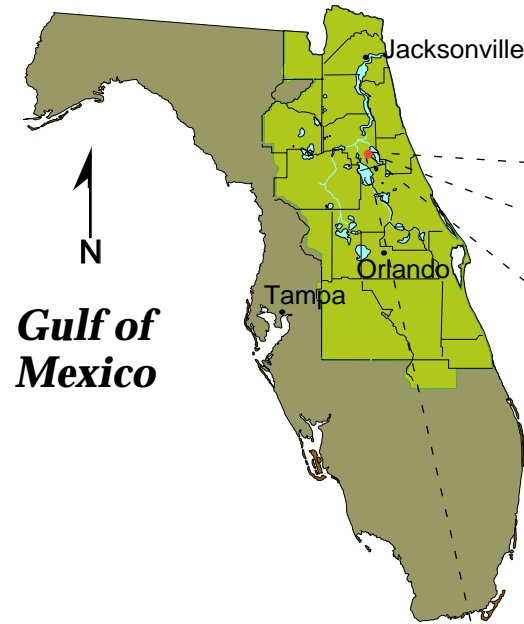


GEOLOGICAL CHARACTERIZATION OF LAKE COMO

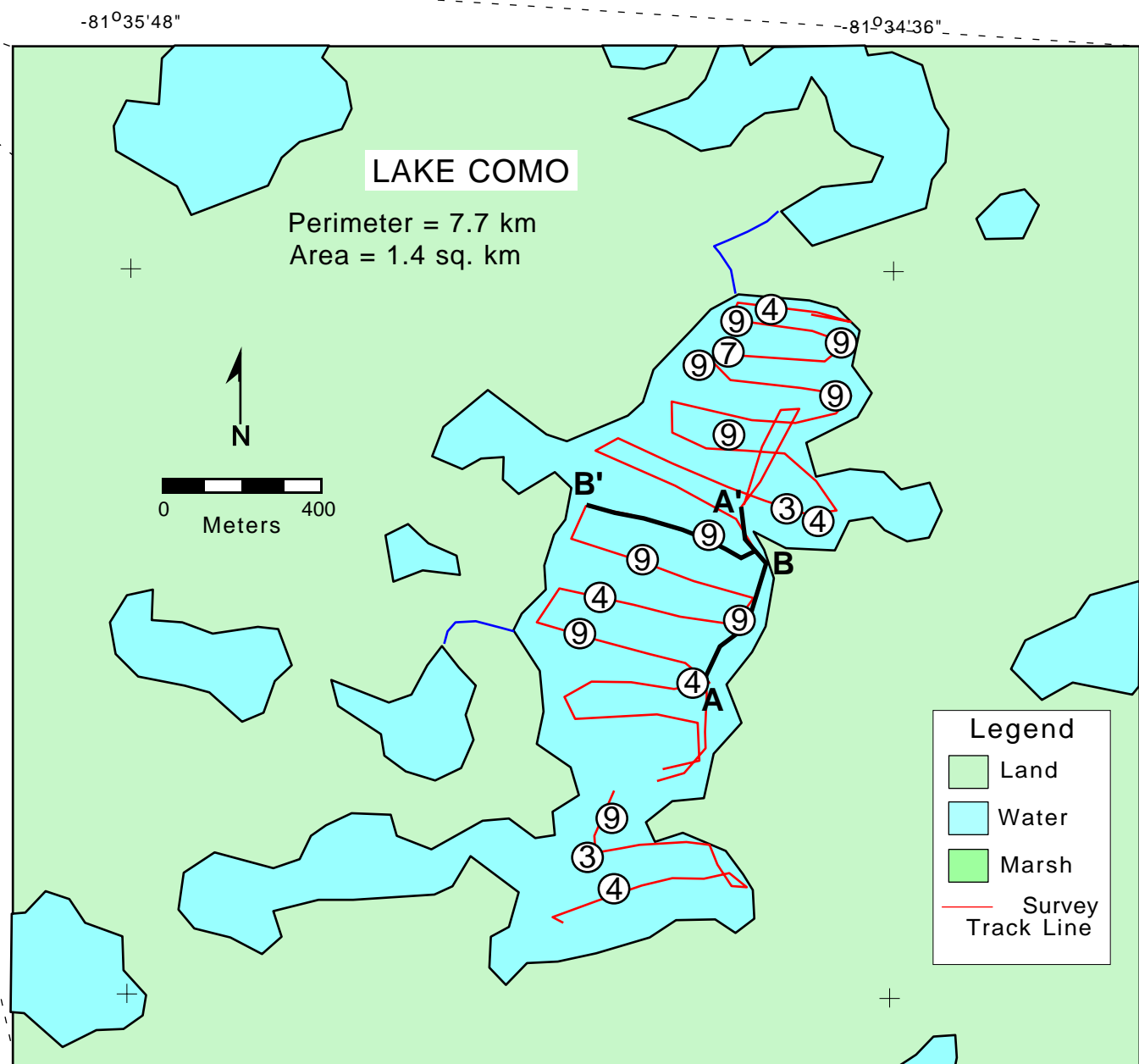
PUTNAM COUNTY, FLORIDA

By
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1997

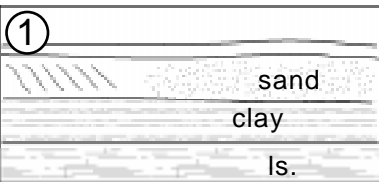
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Gulf of Mexico



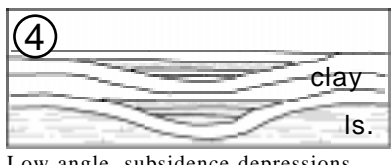
EXPLANATION



Undisturbed section, with or without upper non-reflective sand layer. Sand layer may show reflection where cross bedding from original deposition (fluvial or aeolian) exists. Clay layers are mostly intact.



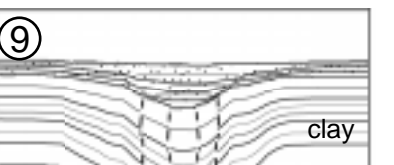
Horizontal reflectors continuous on either side of a central non-reflective zone. Horizontal layers bend downward towards the central zone. These features are representative of filled collapse sinks. The size may range from tens of meters to kilometers across a lake basin.



Low angle, subsidence depressions. Parallel reflectors are relatively intact. Horizontal reflectors onlap onto the subsided parallel reflectors and represent deposition during subsidence. These can be large basin size features or tens of feet.

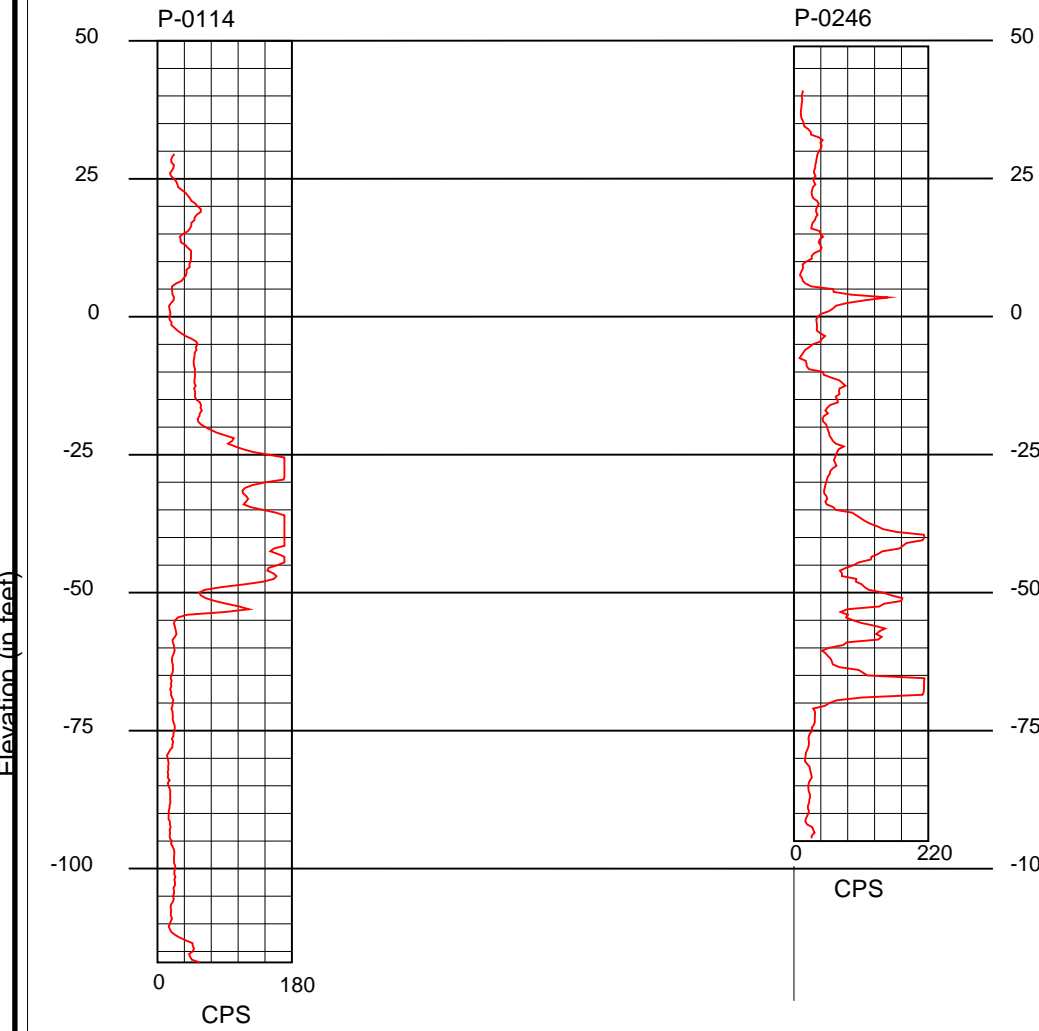


Mid- to high-angle parallel reflectors with indications of vertical displacement and rotation. Feature may be buried by overburden. Represents blocks from the sides of collapse sinks that have slumped into the sink.



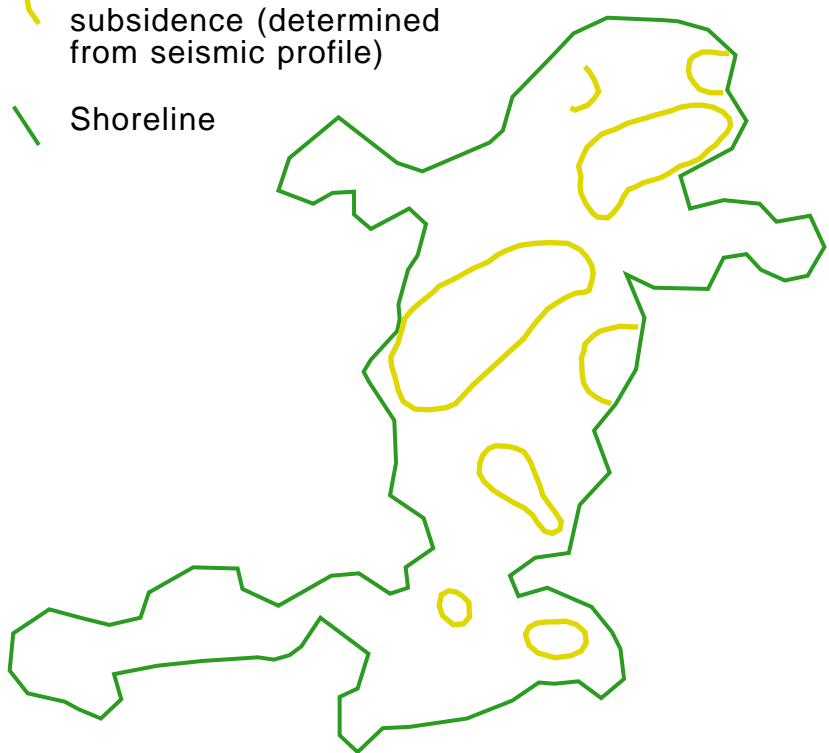
Low- to mid-angle subsidence depressions. Parallel reflectors have undergone displacement and rotation, creating stress fractures and faulting within the depression. The subsidence may or may not be filled with overburden.

Natural Gamma Logs Near Lake Como



Areas of subsurface subsidence (determined from seismic profile)

Shoreline



INTRODUCTION

The potential fluid exchange between lakes of northern Florida and the Floridan aquifer and the process by which exchange occurs is of critical concern to the St. Johns River Water Management District (SJRWMD). High-resolution seismic tools with relatively new digital technology were utilized in collecting geophysical data from > 40 lakes and rivers. The data collected shows the application of these techniques in understanding the formation of individual lakes and rivers, thus aiding in the management of these natural resources by identifying breaches or areas where the confining units are thin or absent between the water bodies, the Intermediate aquifer and the Floridan aquifer.

This study was a cooperative investigation conducted from 1993 to 1996 by the SJRWMD and U.S. Geological Survey Center for Coastal Geology (USGS). Since 1989 there have been technical and hardware advances in the digital acquisition of high-resolution seismic data. The primary objective of this cooperative was to test newly developed digital high-resolution single-channel marine seismic continuous-profiling-equipment (HRSP) and apply this technology to identify subbottom features that may enhance leakage from selected lakes and the St. Johns River. The target features include: (1) identifying evidence of breaches or discontinuities in the confining units between the water bodies and the aquifer, and; (2) identifying areas where the confining unit is thin or absent.

METHODS

In cooperation with SJRWMD the USGS acquired and upgraded a digital seismic acquisition system. The Elics Delph2 High-Resolution Seismic System was acquired with proprietary hardware and software running in real time on an Industrial Computer Corp. 486/33 PC. Hard-copy data was displayed on a gray scale thermal plotter. Digital data was stored on a rewritable Magneto-Optical compact disk. Navigation data was collected using a Trimble GPS or PLGR (Rockwell) GPS. GeoLink XDS mapping software was used to display navigation.

The acoustic source was the Hunttec Model 4425 Seismic Source Module and a catamaran sled with an electromechanical device. Occasionally, an ORE Geopulse power supply was substituted for the Hunttec Model 4425. Power was set at 60 joules or 135 joules depending upon conditions. An Innovative Transducers Inc. ST-5 multi-element hydrophone was used to detect the return acoustical pulse. This pulse was fed directly into the Elics Delph2 system for storage and processing.

Forty-four line-km of HRSP data was collected from Lake Disston. A velocity of 1500 meters per second (m/s) was used to calculate a depth scale for the seismic profiles. Measured site specific velocity data is not available for these sites.

These surveys were conducted in part to test the effectiveness of shallow-water marine geophysical techniques in the freshwater lakes of central Florida. Acquisition techniques were similar but modifications were necessary. Data quality varied from good to poor with different areas and varying conditions. As acquisition techniques improved so did data quality in general. In many areas an acoustic multiple masked much of the shallow geologic data.

Physiography

Lake Como is located on the Crescent City Ridge in south central Putnam County, Florida. Lake level is about 12.2 m (40 ft) NVGD. Lake Como has an irregular shoreline, with a perimeter of about 18.6 km and the surface area of 36.7 sq km. In the immediate vicinity around the lake are numerous smaller lakes, a couple of which are connected via surface flow to Lake Como.

GEOLOGIC CHARACTERIZATION

Seismic profiles in Lake Como show many small (less than 100 meters), low angle reflectors overlain and onlapped by horizontal reflectors (A-A' and B-B'). This acoustic signature has been interpreted to be surficial subsidence features which have been subsequently filled with material, as depicted graphically below (Type 4). The areas of localized subsidence have been mapped out in the figure to the right. The subsidence features appear to be controlled at depth by collapse in the underlying structure. This is shown in example A-A' with downwarped reflectors and subsidence-related faulting (Type 9). Elsewhere in the lake, overburden appears to be displaced and rotated as it slumps into the depression (Type 7, index map). Logs from wells in the vicinity of the Lake place the top of the Hawthorn Formation at about 20 meters and the top of the Ocala at about 30 meters. This would indicate the reflector shown in red (A-A') represents the top of the Hawthorn. However, the sink is probably created by structural collapse in the underlying Ocala Formation.

